

# Symptoms and Syndromes

## 16 Oedema and ascites

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## 1 Water and electrolyte balance

**Water** is the most indispensable factor of life. By means of carefully coordinated regulatory mechanisms, the *water equilibrium* and hence the reservoir of body water is held constant. It is important to keep water intake and output in balance to maintain *isovolaemia*. (s. fig. 16.1)

**Water** is present in a free (non-osmotically bound) state and as a chemically bound hydrate solid structure. • The **clearance** of free water is controlled by vasopressin; it is calculated from the volume of urine/minute minus the osmolal clearance. A normal daily fluid intake of 1,700–2,200 ml (25–30 ml/kg BW) in addition to some 300 ml oxidation water is balanced by a fluid discharge of approximately 1,500 ml as urine, about 100 ml in stools, roughly 600 ml as perspiration and some 400 ml as expired air. (s. fig. 16.1)

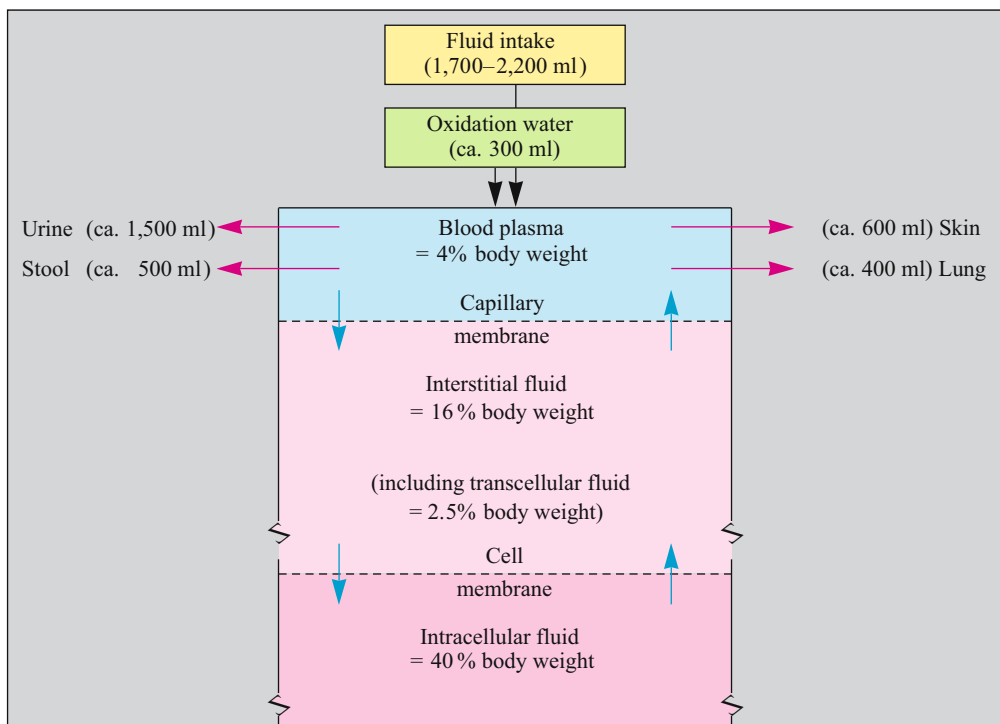
About 60% of the body's weight (ca. 55% in women) consists of water. The reservoir of body water is distributed between the **intracellular space** (ca. 40% of BW) and the **extracellular space** (ca. 20% of BW). The extracellular compartment consists of plasma fluids (ca. 4% of BW) and interstitial water (ca. 16% of BW), the latter also containing transcellular water (ca. 2.5% of BW). Because of its high degree of permeability, the body water is evenly shared between the intracellular and extracellular compartments. The water distribution between plasma and interstitium, regulated by **Starling's forces**, depends on the hydrostatic and colloidosmotic pressure gradients along the capillary walls. • **Disturbances in the excretion of water** are derived from (1.) an increase in ADH activity, (2.) a reduction in distal filtrates available in the nephron, and (3.) greater absorption of water in the distal nephron, independent of ADH. Disruptions in the body water pool cause changes in serum sodium or serum osmolality.

**Electrolytes** are subject to dissociation into negatively charged anions and positive cations. The vital *electrolyte balance* guarantees the respective uptake and discharge and ensures the correct presence and distribution. This regulatory process is closely linked to the water equilibrium. The intracellular and extracellular spaces differ in their electrolyte content. (s. tab. 16.1)

	Plasma	Interstitial space (mval/l)	Intracellular space (mval/l)
<b>Cations</b>			
Sodium	142	145	10
Potassium	4	4	160
Calcium	5	5	2
Magnesium	2	2	26
	153	156	198
<b>Anions</b>			
Chloride	101	114	3
Bicarbonate	27	31	10
Phosphate	2	2	100
Sulphate	1	1	20
Organic acids	6	7	–
Proteins	16	1	65
	153	156	198

**Tab. 16.1:** Constituents of the most important electrolytes (in mval/l) in extracellular and intracellular fluid

► An **ionogram** of the fluid spaces compares the cation and anion content in milliequivalents, since it is not the weight, but the chem-



**Fig. 16.1:** Fluid spaces and exchange of water (blood plasma + interstitial fluid = extracellular space, intracellular fluid = intracellular space)